Seedling Emergence in Wheat as Influenced by Planting Depth and Temperature

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Two important wheat varieties, C.273 and Dirk, were tested for their total emergence and speed of emergence under varying temperature and planting depth. The variety, C.273, was generally found to emerge faster and produce a better stand than the variety, Dirk. This indicated that the former variety had a wider adaptive range and could be preferred to Dirk for cultivation under conditions likely to result in poor stand.

INTRODUCTION

The extent of seedling emergence is one of the most important agronomic factors known to affect critically the overall performance, and ultimately, the grain yield of cereal crops. Poor seedling emergence results in an unsatisfactory crop stand, an initial disadvantage, that the crop fails to effectively overcome, in spite of all subsequent efforts, to bolster its yielding potential through better agronomic treatments. Speed of emergence which is regarded as indicative of the seedling vigour is genetically controlled, but it can be considerably improved by suitably modifying the environments in which the seed is germinating. Work on defining all such factors as may appreciably affect speed of germination, seedling emergence and the resulting stand establishment in different wheat varieties has not yet received much attention from the agronomists in this country. In other countries, however, a few studies of this nature have been reported recently.

Allan *et al.* (1962) conducted an experiment on rate of seedling emergence of fall-sown wheat and its association with plant height and coleoptile length and noted that coleoptile length of varieties grown at 50 and 90 degrees F. was positively correlated with their emergence rate index. The degree of association was more pronounced at 90°F. In another study Chowdhry and Allan (1963) also reported similar results for four wheat crosses. Sunderman (1964) conducted a similar experiment and noted that varieties grown in field at high temperature had shorter coleoptile than those grown from the same depth

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at low temperature, but they showed higher emergence. Similarly, Burleigh *et al.* (1964) reported that depth of planting had striking effect on percentage of emergence of 8 varieties and selections at both high and low temperatures. Without exception, per cent emergence was the highest at 2-inch planting depth followed by 3 and 4-inch planting depths. This gave direct evidence that temperature combined with increased depth of planting can greatly reduce emergence rate and total stand of the crop. According to Craddock *et al.* (1961), varieties possessing a rapid rate of emergence are highly desirable, especially when it is important to obtain a good stand before the onset of adverse environmental conditions. They stated that some varieties were distinctly different from others in the rate of emergence from deep planting or in crusted or moist soil compacted by rain.

Similar information relating to locally cultivated wheat varieties is not available in the literature. The present study was therefore undertaken to determine behaviour of seedling emergence of the two popular wheat varieties, C. 273 and Dirk, under varying depth and soil temperature.

MATERIAL AND METHODS

The experimental material used in this study consisted of two of the most popular wheat cultivators, Dirk and C. 273, and the experiment was laid out in wooden flats measuring 3 ft. $\times$2 ft $\times$3 inches evenly filled with sandy loam soil. The design used was completely randomized one with three replications ; the experiment was repeated thrice at different intervals to introduce temperature variation into the trial and study its effect. The soil moisture at the start of each experiment measured nearly 11 per cent and indicated a perfect *vattar*. The seed was planted 1 inch and 2 inches deep by means of a graduated stick. Each flat was divided into four parts and in each part the variety and depth of planting were randomized thus obtaining, in all, three repeats of the experiment.

A total of 75 seeds of each variety were planted in three flats. The flats were kept in the laboratory throughout and were not watered after planting. The laboratory temperature was recorded daily for the duration of the experiment. The laboratory was open and airy, but, however, the flats did not receive direct sunlight.

The emergence of seedlings was recorded twice daily and the data thus collected were pooled to compute emergence percentage and emergence rate index. In order to calculate emergence rate index of wheat seedlings, the first reading in every set of the experiments was multiplied with the total number of readings in that experiment to give due weight to that value ; the 2nd reading of the experiment was multiplied by the total number of readings

in the experiment minus one ; the third reading was multiplied by the total number minus two, and thus continuing the process, the last reading was multiplied by one. Having multiplied this way all the readings in an experiment, the products were added up and the sum total reduced to a smaller value by dividing it by a common factor, *e.g.*, the number of readings in each experiment. The value thus obtained represented the emergence rate index (ERI) of wheat seedlings.

TABLE 1. *Emergence percentage and emergence rate Index of wheat seedlings at two depths of planting under different temperature conditions.*

Duration of experiments	Emergence percentage				Emergence rate Index				Average day and night temperature
	1" depth		2" depth		1" depth		2" depth		
	C. 273	Dirk	C. 273	Dirk	C. 273	Dirk	C. 273	Dirk	
9-10-65 to 27-10-65	85	75	61	59	163	137	90	82	81°F
2-11-65 to 10-11-65	81	72	70	70	121	117	87	77	74°F
15-11-65 to 26-11-65	81	79	85	71	159	139	141	90	66°F

RESULTS AND DISCUSSION.

The experimental data on per cent emergence and emergence rate index of the two varieties obtained under different growth conditions are presented in Table I.

Total Seedling Emergence

The two wheat varieties, C. 273 and Dirk, showed, on the whole, better emergence and a more consistent growth pattern in that order for 1 inch deep plantings at all temperatures than for 2 inch deep plantings, where seedling emergence of both the varieties was more markedly reduced at 81°F. than at 74° and 66°F. Although the emergence pattern was similar for 1 inch and 2 inches planting depths, the variety, C. 273 surpassing the variety, Dirk, yet the varietal differences were not as pronounced in 2 inch deep plantings

than in 1 inch deep plantings. The total emergence was generally poor except at the lowest temperature of 60°F., where C. 273 emerged much better (85 per cent) than Dirk (71 per cent). A comparable disparity in emergence was, however, lacking for 1 inch planting depth at the same temperature.

Emergence Rate Index

The two varieties differed remarkably in emergence rate index values for both the 1 inch and 2 inch planting depths, the differences being more conspicuous for the former planting depth than the latter at all temperatures. Apparently the varieties emerged faster at 81° and 66°F. but not as fast at 74°F.; here, too, the variety, C. 273, maintained its usual superiority to Dirk.

The results although not quite conclusive revealed a somewhat positive relationship between total seedling emergence and emergence rate index at 66° and 81°F. for both depths, but not precisely so at 74°F. Differential response of the varieties to depth of planting, soil moisture stress and temperature variations for total seedling emergence and rate of emergence seems to be a varietal character. Since the variety, C. 273, performed consistently better than the variety, Dirk, under all conditions of the experiment due apparently to its capability of fast emergence, it must have wider adaptive range compared to the variety, Dirk, which showed less tolerance to soil moisture stress and temperature variation. The variety, C. 273, may, therefore, be preferred to Dirk for cultivation under similar adverse environmental conditions. These findings find further support from the inferences drawn by Burleigh *et al.* (1964).

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